NUMBER THIRTEEN NOTES FROM THE SHOP

Woodsmith™

PROJECTS:

COMPLETE PLANS FOR BUILDING A CLASSIC CONTEMPORARY CABINET/HUTCH

A FREE-FORM ROUTED BOX

STORE-IT-ALL, WHEEL-AROUND SHOP CART

TECHNIQUES:

STEP-BY-STEP FOR BUILDING A GLAZED DOOR

JOINERY: A MORTISE AND TENON WITH CONCEALED RABBET

GLASS CUTTING: IT'S A SNAP

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Woodsmith

Number Thirteen January, 1981

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Talking Shop

ABOUT THIS ISSUE

I realize that the major project in this issue — the Contemporary Cabinet/Hutch — will not appeal to everyone. But we've had several requests for plans for contemporary furniture, and that's the main reason we chose this style. (Besides, I kind of lean toward contemporary myself.)

However, if you don't like this style (or even this particular project), this whole article could be just so much wasted space. That's why we tried to pull out several techniques that could be applied to almost any style of furniture.

Most of you who've been with us a while have probably noticed that we usually present a woodworking technique and then base several projects on that one technique. In this issue, we decided to reverse that theme. This time we have one large project (the hutch) and we've tried to pull out several techniques (glazed doors, muntins, hinges, mortise and tenon, and glass cutting).

Speaking of techniques . . . I ran into a friend of mine in a restaurant the other day. "I finally did it," he proclaimed, "I finally made a mortise and tenon joint. And you were right . . . it's not all that hard."

On pages 10 and 11 in this issue, we've repeated (in a condensed form) much of the information we presented in *Woodsmith* Number Eight on the mortise and tenon joint. This time, showing a variation (a staggered-shoulder tenon) that allows you to make a door frame with a rabbet on the back.

Now, before I get a lot of letters saying that's not the way to cut a tenon, let me say that it's just the way I happen to like cutting them. It's easy, accurate, and most of all, it gets the job done.

Okay Don, I'll agree with easy . . . but accurate? I think it's accurate because you're always using a previous cut to gauge the next one. And in any kind of joinery, I think this approach is superior to any kind of marking — whether with a pencil or a marking gauge. It allows for adjustments for the cuts as they are actually made, not the way they were supposed to have been made. Anyway, this is one guy's approach. (Actually two guys. My friend in the restaurant likes this method too.)

ROUTER, ANYONE?

Almost every woodworker I know gets a router for Christmas. First a toy train, then a super-duper stereo system, and finally a router. It seems to fulfill some basic need for gadgets in our lives. (And, in a way, marks one of life's transitions.)

Granted, routers are amazing machines that set the mind spinning with possibilities. Yet, they frequently wind up doing the job of a shop vac—collecting dust.

I finally decided to dust off my router and put it to work. The result is the routed jewelry box shown on page 12. This project, I think, points out one of the reasons routers don't see much action. In order to realize its full potential, a router needs some help — an attachment, a guide, a bushing or, in this case, a template. When teamed up with a template, a router is ideally suited for projects like this. And, it's a project that can't be done with any other kind of machine. Route on.

One last note: We're beginning to run out of tips sent in by readers. If you want to contribute to the Tips & Techniques page please don't hold back . . . send them in.

NEXT MAILING: March 2, 1981

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Required by 39 U.S.C. 3685)

1. Title of Publication: Woodsmith. 1a. Publication Number: 465410. 2. Date of Filing: October 1, 1980. 3. Frequency of Issue: Bimonthly. 3a. Number of Issues Published Annually: six (6). 3b. Annual Subscription Price: $10. 4. Location of Known Office of Publication: 1912 Grand Avenue, Des Moines, Iowa 50309. 5. Location of the Headquarters or General Business Offices of the Publishers: Same. 6. Names and Complete Addresses of Publisher, Editor, and Managing Editor: Publisher/Editor Donald B. Peschke, 1912 Grand Avenue, Des Moines, Iowa 50309. 7. Owner: Donald B. Peschke, 1912 Grand Avenue, Des Moines, Iowa 50309. 8. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent Or More of Total Amount of Bonds, Mortgages or Other Securities: None. 9. Does Not Apply. 10. Extent and Nature of Circulation:

	Average no. copies each issue during preceding 12 months	Actual no. copies of single issue published nearest to filing date (September 1, 1980
A. Total no. copies printed (net press run)	7,666	12,050
B. Paid Circulation		
1. Sales through dealers and carriers, street vendors and counter sales	97	232
2. Mail Subscriptions	5,583	9,413
C. Total paid circulation (Sum of 10B1 and 10B2)	5,680	9,645
D. Free distribution by mail, carrier or other means samples, complimentary, and other free copies	180	15
E. Total distribution (Sum of C and D)	5,860	9,660
F. Copies not distributed		
1. Office use, left over, unaccounted, spoiled after printing	1,806	2,390
2. Returns from news agents	-0-	-0-
G. Total (Sum of E, F1 and 2 — should equal net press run shown in A)	7,666	12,050

11. I certify that the statements made by me above are correct and complete. (Signed) Donald B. Peschke, Publisher/Editor.

Subscription Questions? Call 800-333-5075, 8:00 AM to 5:00 PM, Central Time, Monday through Friday. Fax: 515-283-0447.

WOODSMITH® (ISSN 0164-4114) is published bimonthly (January, March, May, July, September, November) by Woodsmith Publishing Co., 2200 Grand Ave., Des Moines, Iowa 50312.

Tips & Techniques

SANDING GLASS

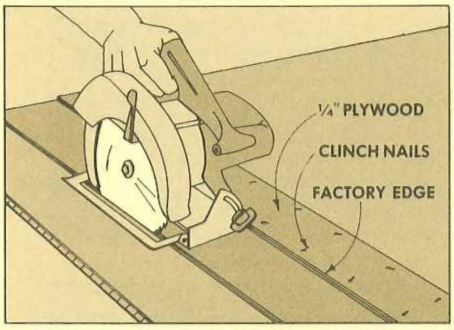
When I cut glass and it has a rough edge on it, I sand the edge smooth with a piece of fine emory paper mounted to a block of wood. Just before sanding, I squirt some *WD-40* on the emory paper. Then I rub the edge of the glass, back and forth, in long even strokes.

After a short time the edge of the glass will be smooth enough to run your finger over it (without cutting yourself).

Edward H. Rachuha
Lansdowne, Maryland

SHOOTING BOARD

Whenever I have to make an accurate cut on a sheet of plywood, I use this fixture. I call it a shooting board. First I cut two pieces of ¼" plywood and nail them together as shown in the drawing. (I nail up from the bottom — through the base and into the fence. This way the points of the brads can be clinched over on the top where they won't interfere with anything.)



I mount the top "fence" on the base so the factory edge is out — that is, so it guides the base (shoe) of my saw. The base piece is cut wider than necessary at first — then I put the saw against the fence and cut a clean edge on the outside edge of the base.

This clean edge can now be used to accurately align the fixture because I know the blade will cut exactly on this edge. All I have to do is measure for the cut, fasten the shooting board to the plywood sheet with ¾" brads (I don't use clamps), and make the cut. The shooting board should be mounted on the "good" side, so the blade cuts on the waste side of the line.

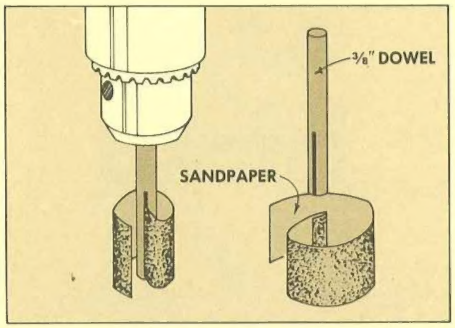
Edward H. Rachuha
Lansdowne, Maryland

Mr. Rachuha also mentioned that this fixture is helpful for making angled cuts. We used it to cut the angled edge on the Contemporary Hutch in this issue.

SMALL SANDING DRUM

I make a lot of small toys with short radius curves. Most sanding drums are too large for these curves, so I had to make my own.

My sanding drums are made from aluminum rods of various diameters. All of mine are 5" long with a 2" slot cut in one end.



In use, I slip a piece of sandpaper in the slot, chuck it in the drill press and sand away. As I move the workpiece up to the rod, the sandpaper curls around the rod to form the drum. As an alternative, you can put rubber cement on the back of the sandpaper to fasten it to the rod, or secure it with a rubber band.

John K. Seidel
Atlanta, Georgia

We used this sanding drum tip to sand the walls of the routed box shown on page 12. We even tried it in a portable electric drill . . . it worked this way too.

JUST A SMIDGEN

Once I was routing a ½" groove in a board to accept a ½"-thick piece of plywood. Either the plywood was too thick, or my ½" bit was too narrow, but the plywood would not fit.

I was using a clamped-on board as a guide for the router and had to move it just a smidgeon — yet keep it parallel to the original groove. This was a real problem.

I finally struck on the idea of putting a piece of masking tape along the guide board. This, in effect, moved the router over the smidgeon I needed, widening the groove. The same effect can be achieved by putting the tape on a router guide or on the edge of the router base. Additional pieces of tape increase the margin in small increments. And, for continued use, I use reinforced tape.

Roger Ziegler
Jefferson, Wisconsin

SMALL SANDING DISK

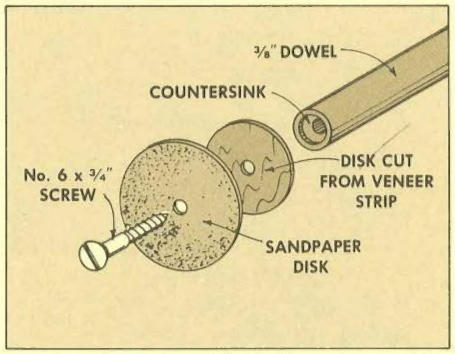
Back in *Woodsmith* Number Ten I made a small routed tray for holding coins. After that issue came out, a subscriber called and asked how I sanded the bottoms of the trays. The only answer I could give at the time was that I used a piece of sandpaper and the (sore) tip of my finger.

I faced the same problem with the routed jewelry box in this issue, and wore out three fingers sanding the bottom of this box. With my last remaining finger, I scratched my head and came up with a better way.

The drawing shows the basic set-up with a ⅜" dowel and a disk cut from a strip of veneer. To cut the disk, I used a *Stanley* Power Bore bit, which has just enough cutting edge to cut a circle in the veneer without chewing it up (if you're careful).

I cut the sandpaper disk with a pair of old scissors I have in the shop. (No, I didn't use the "good" scissors.)

In use the sanding disk is mounted in a portable electric drill. I went through a



couple of veneer disks before the sanding was done . . . but it sure saved my fingers.

Don

SEND IN YOUR IDEAS

We invite you to share your woodworking tips and techniques with other readers of *Woodsmith*. We will pay a minimum of $5 for a tip, and $10 or more for a special technique. All material submitted becomes the property of Woodsmith Publishing Co. Upon payment, you give *Woodsmith* the right to use the material in any manner for as long as we wish.

If your idea involves a drawing or photo to explain it, do your best and, if necessary, we'll make a new drawing, or build the project or jig and photograph it. (Any drawings or photos submitted cannot be returned.)

Send your ideas to: *Woodsmith*, Tips & Techniques, 2200 Grand Ave., Des Moines, Iowa 50312.

Contemporary Hutch

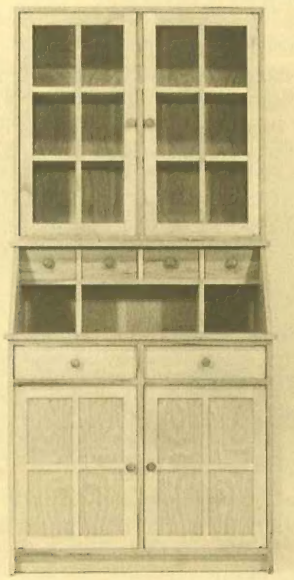
THE CLEAN LINES OF A CONTEMPORARY CLASSIC

I want to be honest about the design of this hutch. First of all, Ted Kralicek (our Art Director) designed it (so I feel free to make the next statement). I like it. It has a clean, contemporary look — much like the furniture currently being built in northern Europe and the Scandinavian countries.

But apart from the appearance, I like the design for two other reasons. Ted managed to arrange the Cutting Diagram so all of the pieces are cut from 1½ sheets of Maple-veneer plywood. And, as you can see, there's not a whole lot of waste (which appeals to my sense of design).

The other thing I like about the design is the recessed doors. They're set back ⅜" with a very tight fit in the cabinet. This is not an easy design concept to work into a piece of furniture. (It takes special hinges and a lot of planning.)

And I guess there's one last thing. As I look at this hutch, I see a lot of strong lines and islands (rectangles) where the eye can rest — very similar to a Mondrian painting. Well, enough philosophy, on to the building.

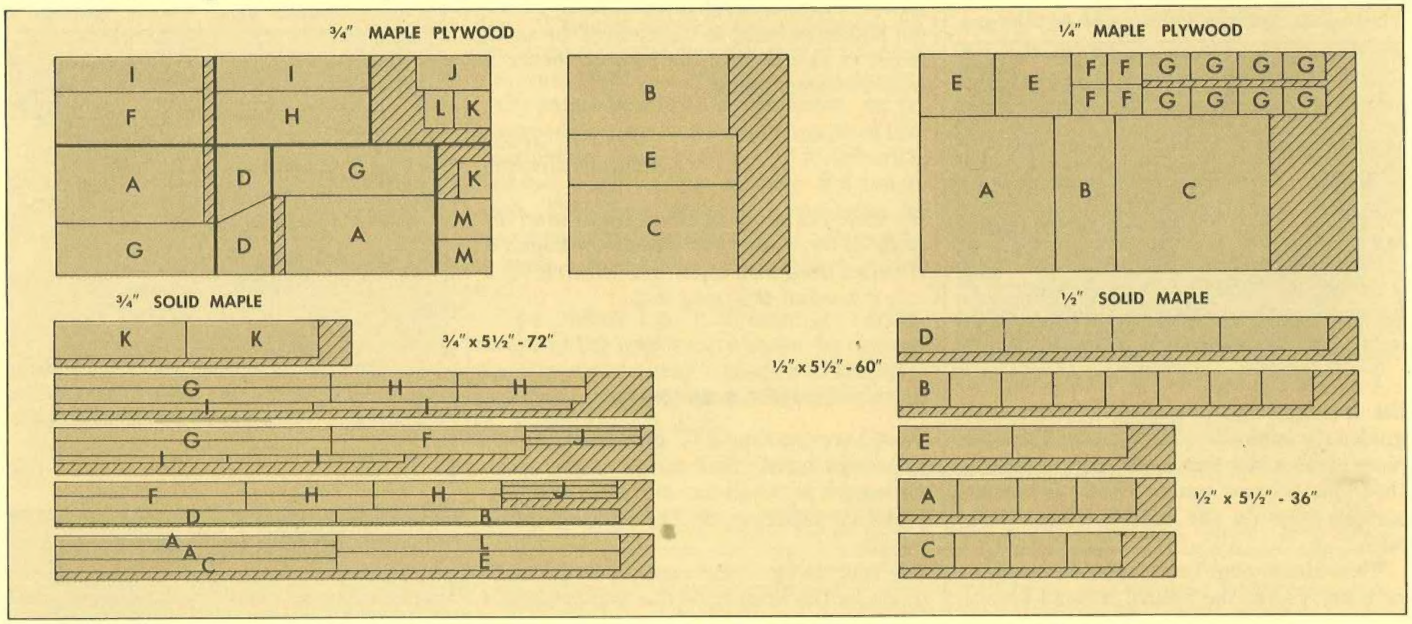


THE CUTTING DIAGRAM

The Cutting Diagram doesn't allow for much waste — especially in the width. And, considering that the Maple plywood we used cost us about $50 per sheet, we didn't want much waste . . . and we certainly didn't want to blow any cuts.

We started by cutting the 4' x 8' sheet into seven manageable pieces. (The heavy lines indicate these cuts.) Just to insure that we'd have a little room for final trimming, we marked out each piece on the sheet before cutting.

All of the initial cuts were made with a portable circular saw (Skil saw) with a plywood blade. To do this we used a strip of ¼" Fir plywood as a fence. After the initial cuts were made, we cut all pieces for the base cabinet to finished size.



The Cutting Diagram shows a suggested layout for cutting the pieces. Finished dimensions are given in Figures 1, 4, and 6.

The following codes are for the pieces cut from the sheets of ¾" maple plywood.

- **A Base Cabinet, Sides**
- **B Base Cabinet, Bottom**
- **C Middle Section, Bottom**
- **D Middle Section, Sides**
- **E Middle Section, Top**
- **F Top Cabinet, Bottom**
- **G Top Cabinet, Sides**
- **H Top Cabinet, Top**
- **I Top Cabinet, Shelves**
- **J Pigeon Hole, Shelf**
- **K Pigeon Hole, Shelf**
- **L Pigeon Hole, Divider**
- **M Pigeon Hole, Divider**

The following codes are for the pieces cut from the ¼" maple plywood (4' x 8' sheet).

- **A Base Cabinet, Back**
- **B Middle Section, Back**
- **C Top Cabinet, Back**
- **E Drawer Bottoms, large**
- **F Drawer Bottoms, small**
- **G Door Panels**

The following codes are for the pieces cut from the ¾" x 5½" - 72" solid maple.

For Base Cabinet:

- **A Frame Rails**
- **B Drawer Rail, front**
- **C Drawer Support, back**
- **D Divider**
- **E Toe Board**

For Doors and Drawers:

- **F Door Stiles, Base**
- **G Door Stiles, Top**
- **H Door Rails**
- **I Muntins (vertical)**
- **J Muntins (horizontal)**
- **K Drawer Front, Base**

For Top Cabinet:

- **L Divider**

The following codes are for the pieces cut from the ½" x 5½" solid maple (5' and 3').

- **A P.H. Drawer Fronts**
- **B P. H. Drawer Sides**
- **C P. H. Drawer Backs**
- **D Base Drawer Sides**
- **E Base Drawer Backs**

THE BASE CABINET

We started construction with the base cabinet, cutting the sides and bottom to finished size from the ¾" Maple plywood. Then the other six pieces needed were cut to rough length from ¾" solid maple. These pieces are shown in the Cutting Diagram for the cabinet, Fig. 1. They include: the two top rails which complete the "surround" of the cabinet; the front drawer rail and back drawer support which support the hardware for the drawers; the center divider which separates the drawers and doors; and finally the toe board.

Rather than get too elaborate with the joinery for the base cabinet, we decided to use only two basic joints: rabbet and groove, and tongue and groove. Of course, it would have been less work to simply cut a ¾"-wide groove to accept the full thickness of the joining piece, thus avoiding the cuts for the rabbet or tongue. (For example, where the bottom of the cabinet joins the sides.)

But, it seems, whenever I try this there's always (what looks like) a huge gap left showing. So, we chose these joints because the shoulder of either the rabbet or the tongue completely conceals the groove — for a much neater appearance.

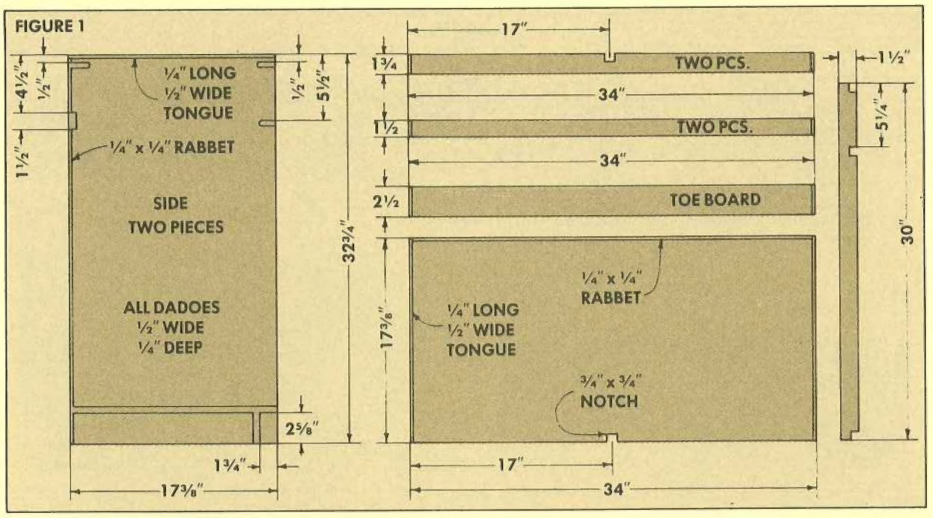
The basic procedure we followed was to cut the groove first and then cut the rabbet or tongue to fit. All of the grooves (in the base cabinet) are a standard ½" wide and ¼" deep. We cut these grooves with a *Stanley* router and a ½" straight bit.

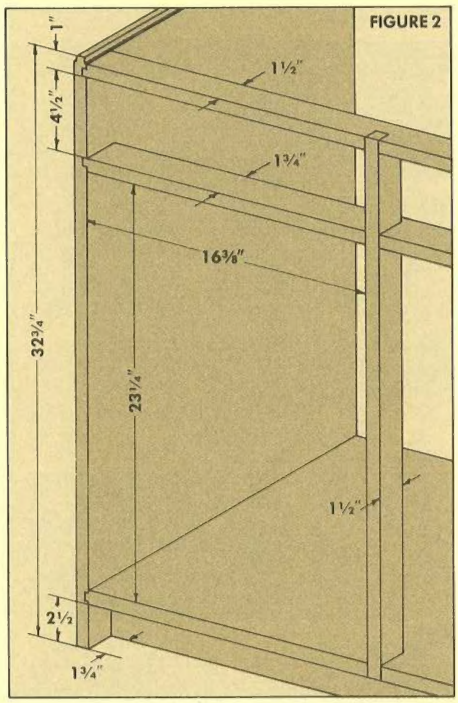
To guide the router, we clamped a 1x4 fence to the workpiece. The "back" of the router was always held against the fence, and during the routing operation, we always moved the router from left to right so the action of the bit "pushed" the router against the fence. (Depending on the cut, this sometimes means you must start the cut with a "plunge cut.")

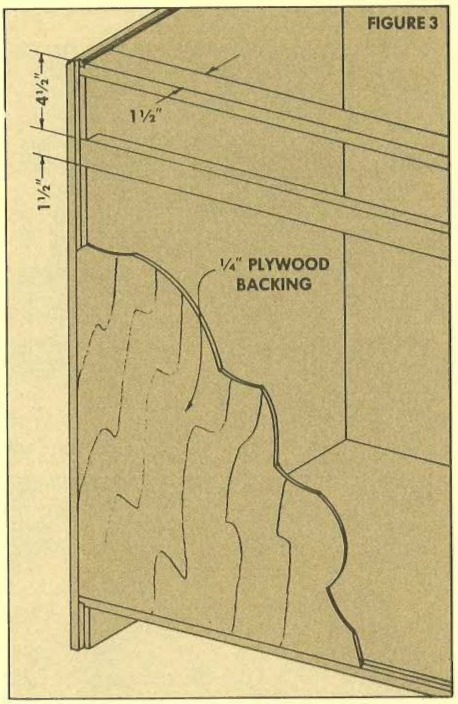
The drawings on this page should tell the story, but I jotted down a few notes: 1) As shown in Detail A the drawer rail is 1¾" wide (all others are 1½"). You need the extra ¼" on this piece so there's room for the drawer hardware.

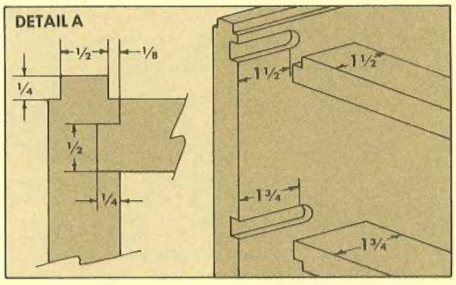
2) The notches in the two front rails (shown in Fig. 2) should be cut at the same time by clamping them together as they're cut. This insures the notches will match up when installed.

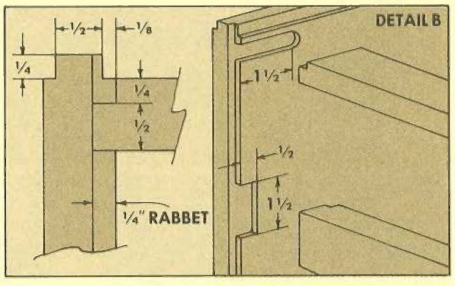
3) After all the pieces are cut, dry-clamp the cabinet together and make sure everything is square. Then proceed with the gluing and clamping, always checking the square. We used *Titebond* glue and eight pipe clamps to glue up the cabinet — one clamp at each of the four rails and four clamps along the bottom. For the divider, a ninth pipe clamp is used to hold it in the notch in the bottom, while C-clamps hold it against the rails at the top.

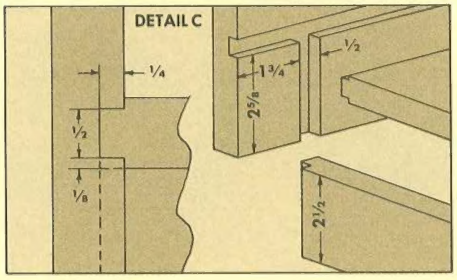


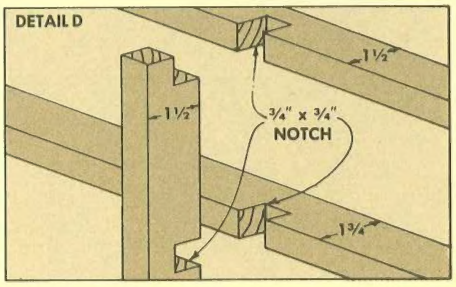


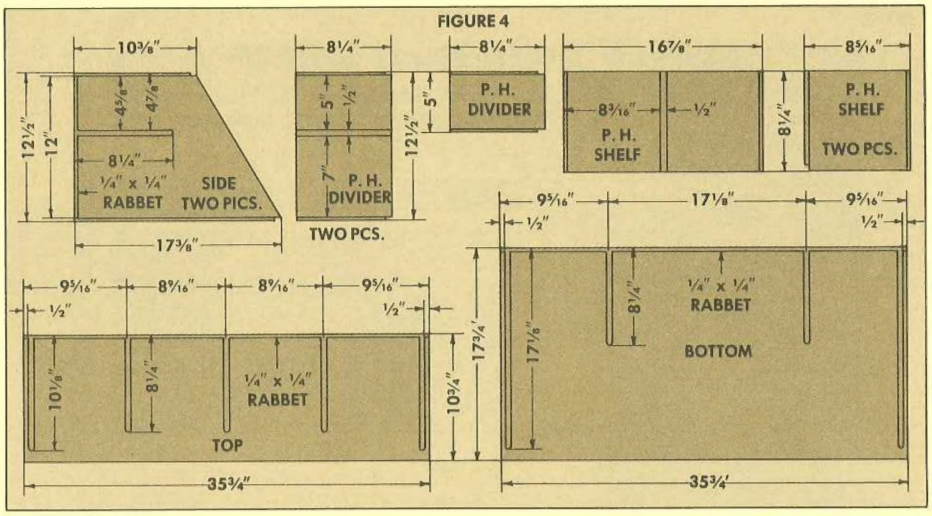


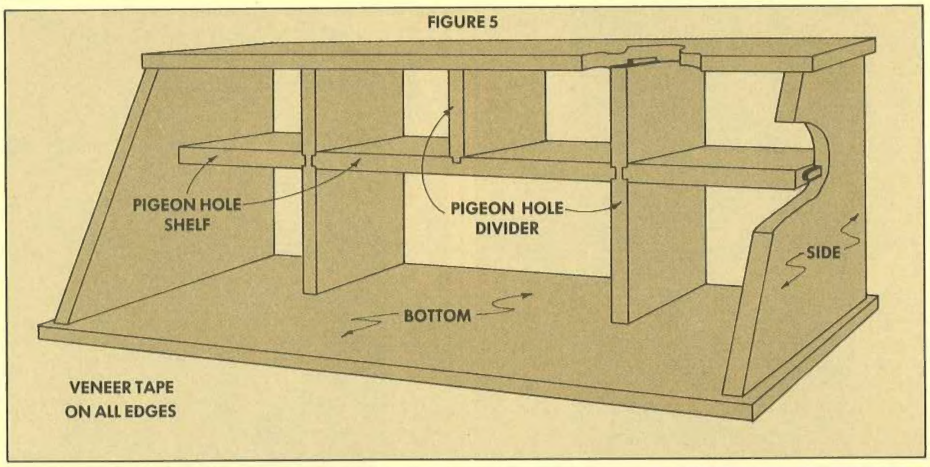


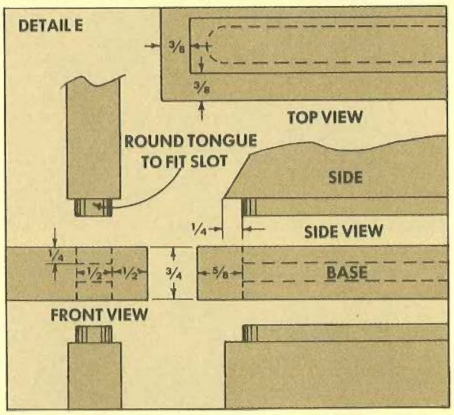


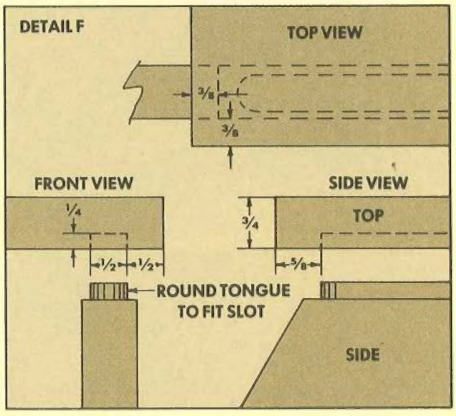


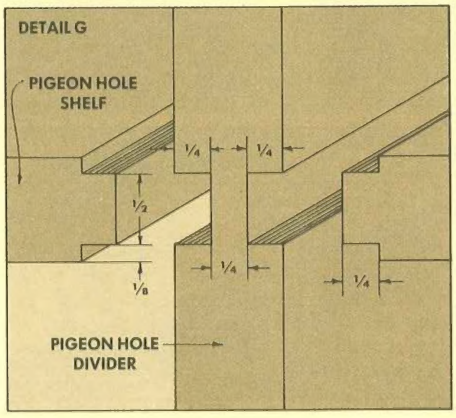


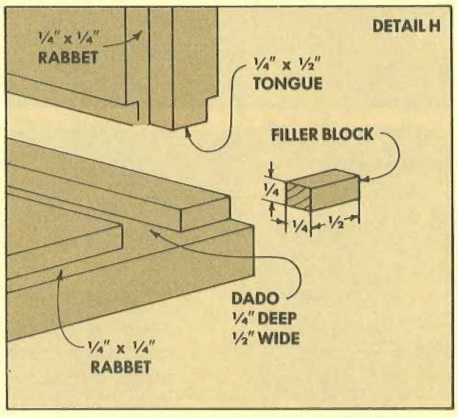












PIGEON HOLE SECTION

At first, we were going to leave this middle section plain and simple. Then we thought it might be nice to add some pigeon holes and small drawers for storing odds and ends. However, this did add quite a bit of work to the project.

The first step is to cut the top, bottom and two sides for this section from the ¾" Maple plywood. The only real problem here is cutting the angle on the side pieces.

The angle is 60°, but since we made this cut with a Skil saw, we cut the back edge square first and then marked a point on the bottom edge 17⅜" from the back, and a point on the top edge 10⅜" from the back and cut along the line between these two points. However, if the angle is marked this way, be sure to mark the two points ¼" up or down from their respective edges to allow for the ¼" tongues.

Before cutting the pieces for the pigeon hole section we went ahead and cut the grooves (and then the tongues) to join this section together. As with the cabinet base, all grooves are ½" wide and ¼" deep.

The bottom piece for this section becomes, in effect, the top of the base cabinet. Because of this grooves must be cut on its underside to mate with the tongues already on the top edges of the sides.

Then four grooves are cut on the top side of this piece to receive the sides and the pigeon hole dividers. Before cutting these grooves, we marked the location of where the front edges of the sides and pigeon hole dividers would be. Then all of the grooves were stopped at least ¼" from these front edge marks to conceal the tongues (refer to Detail E).

This same procedure was followed for marking and cutting the grooves on the top piece. (Note: the measurements given in Fig. 4 indicate the center of each groove.)

After the grooves are cut, the matching tongues are cut in each piece, and then the middle section "surround" can be dry-assembled. This way, accurate measurements can be taken for the pieces of the pigeon hole section — and more grooves cut, followed by more tongues.

Finally, rabbets are cut on the back edges of the top, bottom, and two sides for a ¼" plywood back. The only problem here is that the rabbet on the top and bottom pieces clips off a small section that shouldn't be clipped off. We simply added a small filer block here, rather than trying to stop this rabbet (Detail H).

Now this whole section can be glued and clamped together, and plunked on the cabinet base. Before gluing it onto the cabinet, we found it more convenient to finish all of the exposed plywood edges with veneer tape. (We used an iron-on type, *Edgemate* Real Wood Edging, which proved to be good quality.)

THE TOP CABINET

When you get down to it, the top is really just a box with shelves and glass doors. This top cabinet is meant to be a separate unit that simply rests on the base section. With this in mind, we had to change the joinery a little. Here we used miter and spline joints to hide the plywood edges at all four corners, see Detail I. (For more information on miter/spline joinery, see *Woodsmith* Number Seven.)

After mitering the ends of all four pieces, we cut a ⅛" groove very close to the inside edge for a ⅛" plywood spline. Then ½" x ¼" rabbets were cut on the back edges for the maple plywood back.

Before assembly, grooves are cut in the two sides for the shelves (Detail J). And, notches are cut in the top and bottom for the center divider (Detail K). After assembling the four sides, we installed the shelves and marked the position for the two notches on the divider (Detail L). These notches lend some support to the shelves.

THE DRAWERS

The last step is to build the doors and drawers. We decided to put all of the information for the doors in a separate article so it could be covered in more detail, see next two pages.

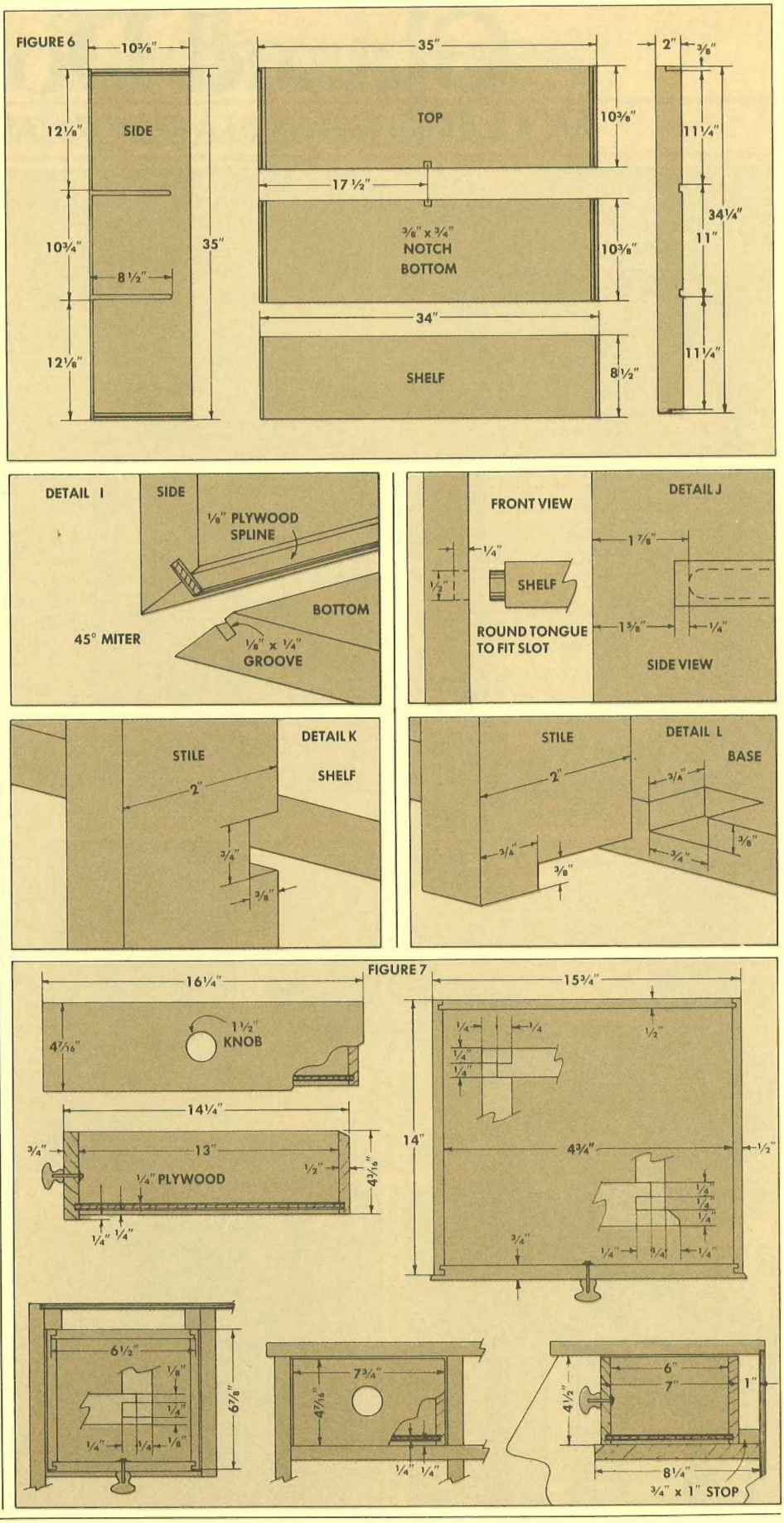
As for the drawers, there are two different kinds: the four small pigeon hole drawers, and the two larger drawers in the base cabinet. We used the same type of joinery on both drawers: a locked tongue and dado. (See *Woodsmith* Number Six for more on this joint.)

The only difference between the two sets of drawers is that the small ones have ½" solid wood fronts and are set back ¼", while the two larger drawers have ¾" solid wood fronts and are set back ⅜".

We intalled the two large drawers with single track drawer slides (*Knape & Vogt KV 1175*). When using these drawer slides the sides of the drawers must stop ¼" from the bottom edge of the drawer front (this allows proper clearance for the rollers). Then, instead of trimming the top edge (as is the usual practice), we simply beveled off the drawer back so it could be tilted and installed in the opening.

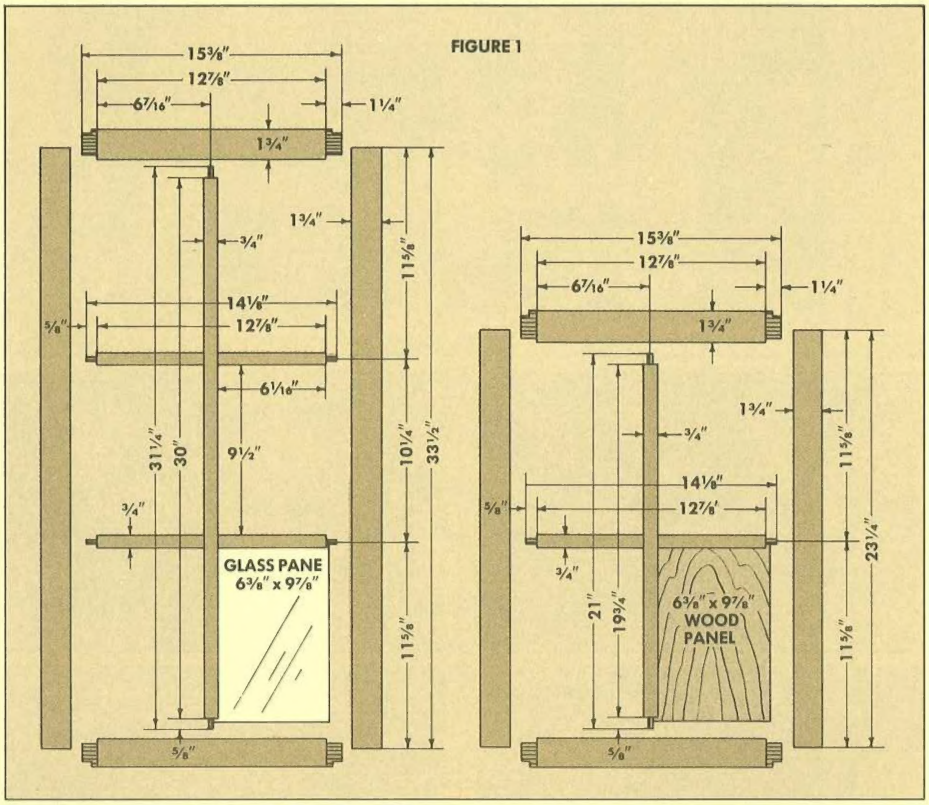
FINISHING

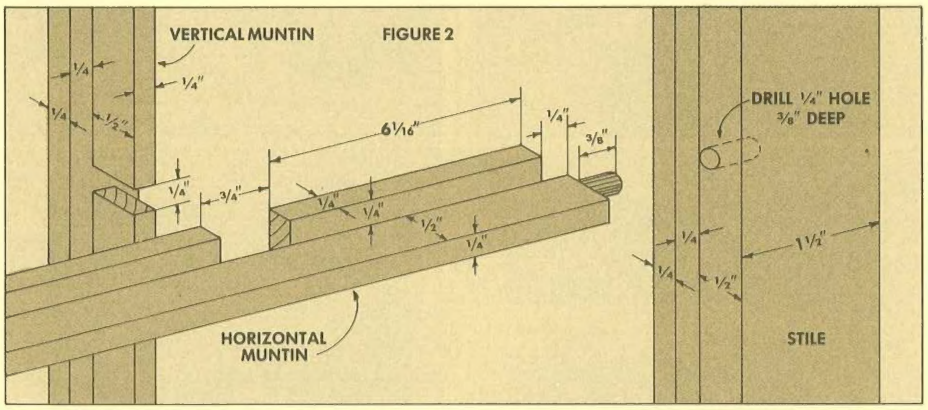
If any kind of stain is put on Maple, it usually obliterates the grain, and begins to look like a color, not a wood. That's why we chose a very natural-looking finish. We applied two coats of *Minwax* Natural stain, which gives the maple a light honey tone, and (I think) will retard yellowing. Then we applied two coats of *Minwax* Antique Oil Finish. (This is an easy-to-apply oil finish, and you don't have to fight with any drip marks.)

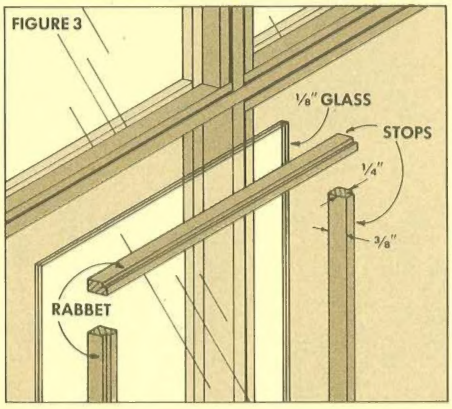


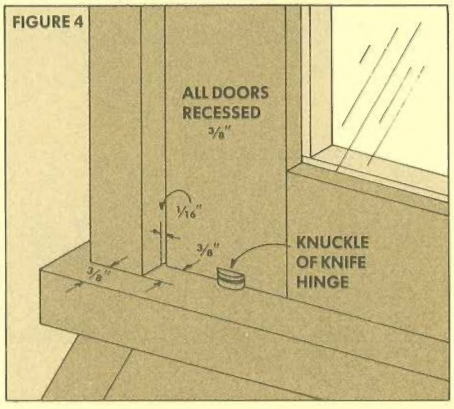
Glazed Doors

MOUNTING GLASS IN A DOOR HAS ITS PROBLEMS









Building a door with glazing requires some special considerations. First, the door frame must be rabbeted on the back to accept the glass. Second, muntins must be cut and mounted to support the individual panes. Third, provisions must be made for repair in case the glass breaks. And fourth, the door must be mounted in the cabinet.

THE DOOR FRAME

We chose a staggered mortise and tenon to join the door frame. (All of the information for this joint is given on the next two pages.) However, before cutting the joints, we cut all of the rails and stiles to fit the *full* dimensions of the cabinet opening. Then after the door was built we trimmed a scant 1⁄16" off all four sides.

THE MUNTINS

We dry-clamped the door frame together and took measurements for the muntins. (Muntins are just T-shaped bars that support the glass panes.) The muntins are secured into the frame with round tenons, and a lap joint is cut where they cross.

INSTALLING THE GLASS

The only problem with installing glass in a door is allowing for the possibility of breakage. We used ¼" x ⅜" stops (see Fig. 3) with little tiny rabbets on them so they could be pried off if necessary.

I should mention one thing about installing the glass and stops. We cut the panes ⅛" smaller (in both dimensions) than the opening. (See page 16 for more on cutting glass.) Also, instead of tacking the stops into the frame (which we found was virtually impossible in maple), we applied two or three small drops of glue on the edge of the stop to fasten it in place.

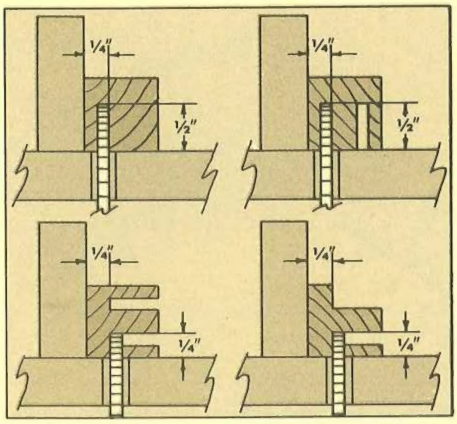
MOUNTING THE DOORS

We wanted to mount the doors so the entire frame was recessed ⅜" from the front edge of the cabinet. This type of installation requires special hinges, "knife hinges," that are made especially for this purpose. Knife hinges (No. D4714) are available for $1.50 per pair from the Woodworkers' Store, 21801 Industrial Blvd., Rogers MN 55374.

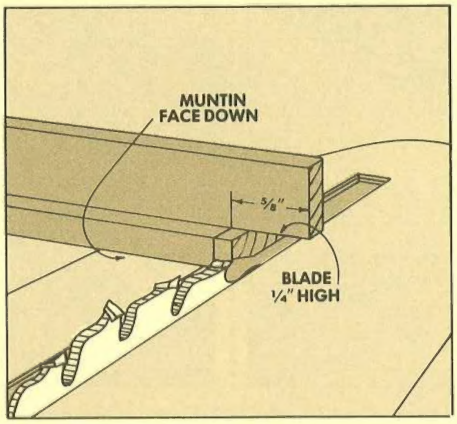
To mount the hinge, cut mortises in the cabinet and the door. Then screw one "blade" of the hinge into the cabinet mortise. Next, push the door into the cabinet opening, sliding it over the hinges. Now, swing the door open for access to the top and bottom edges to screw the other blade into the door mortise.

Door Techniques

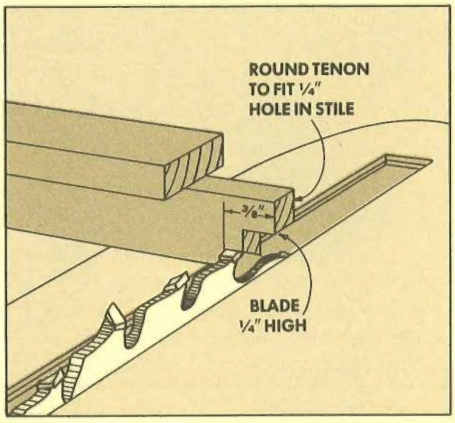
MUNTINS, STOPS AND HINGES



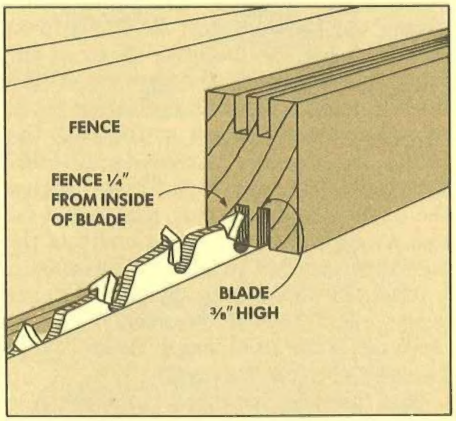
1 *Muntins are T-shaped bars with two rabbets on the back. First cuts: set fence ¼" from outside of blade. Final cuts: set fence ¼" from inside of blade.*



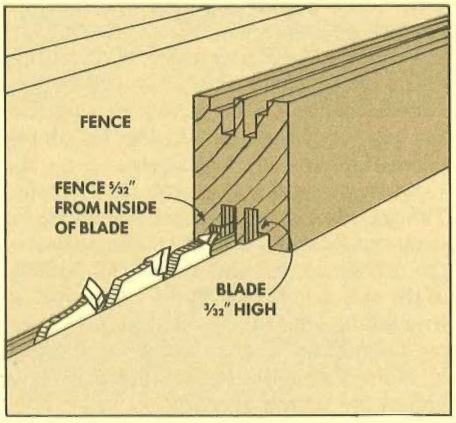
2 *Mark and cut shoulder of muntin where it meets face side of door (⅝" from end). This same type of cut is made to form the half lap where muntins cross.*



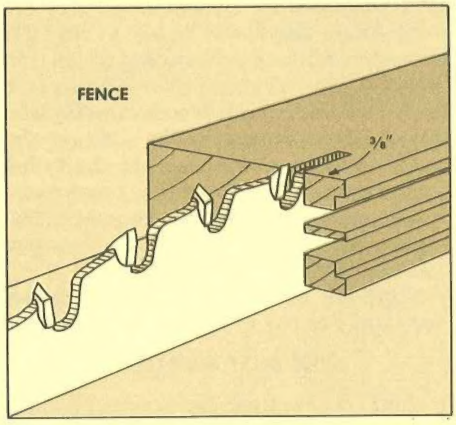
3 *Mark and cut back side shoulder so the muntin fits in the rabbet on back side of door. Then round off the small tenon to fit ¼" holes in door frame.*



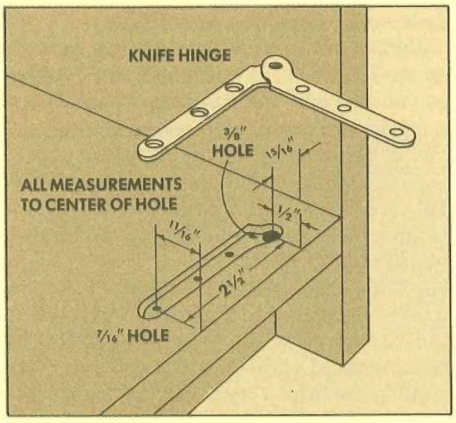
1 *To cut stops: set fence ¼" from inside of blade, and set blade height to a little over ⅜" high. Make four cuts, alternating faces and edges of (1x6) board.*



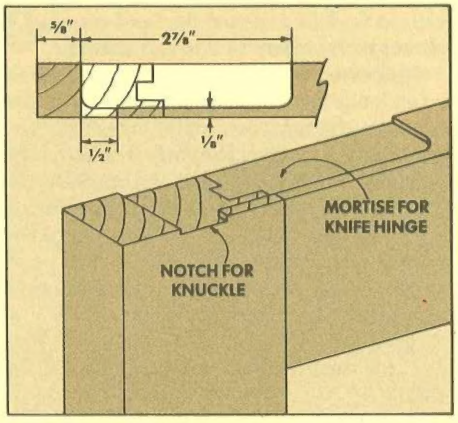
2 *Second cuts form small rabbets so stop can be pried out if necessary. Reset fence 3/32" from the inside of blade, and height of blade at 3/32". Make four cuts.*



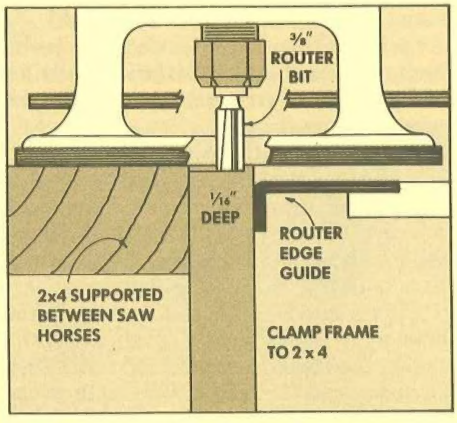
3 *Final cut is rip cut with stops on "waste" side. Set fence so stops extend ⅜" from outside of blade. Fence must be reset to cut stops off opposite edge.*



1 *Mark center line of screw holes 11/16" from front edge of cabinet. Mark outline of hinge and drill holes at knuckle and "tail" of hinge. Chisel out mortise.*



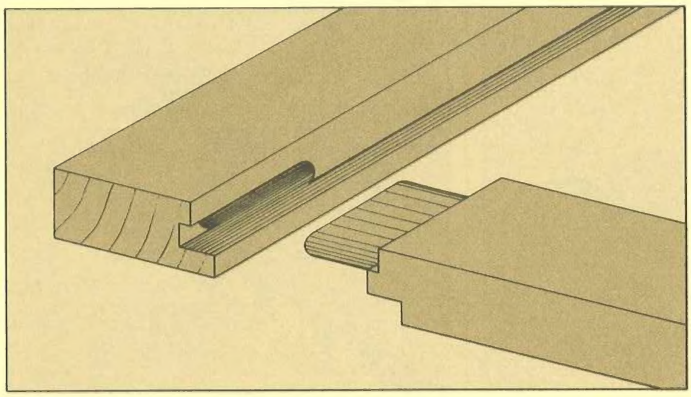
2 *Top and bottom edges of door must be mortised so door can be pushed into the cabinet, over the hinges. Knuckle fits into notch on front edge of door.*

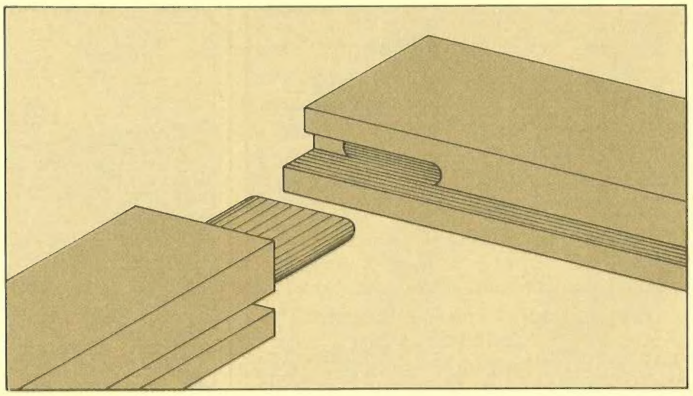


3 *Door mortise: clamp door frame to a 2x4 supported between two saw horses, so edge of door aligns with 2x4. Use router with edge guide to route out mortise.*

Mortise and Tenon

A SLOT MORTISE & STAGGERED-SHOULDER HAUNCHED TENON





Back in *Woodsmith* Number Eight we ran a rather lengthy article about what I think is a very easy and accurate method for cutting a mortise and tenon joint. In this issue we used a variation of this joint to build the doors for the hutch.

Basically, this variation allows for (and conceals) a rabbet on the back of the door to accept a pane of glass. Shown above are two views of this joint. The mortise is just a typical slot mortise with the addition of a small notch for the haunch in the tenon and, of course, the rabbet. The tenon looks more complicated than it is because of the rabbet, and the staggered shoulder which conceals the rabbet.

Note: All of the measurements given here apply to the doors for the hutch.

THE SLOT MORTISE

I think the easiest (and certainly the cheapest) way to make a mortise is the European method: a slot mortise. Typically, a mortise is a rectangular hole. But in order to get those nice square corners, you have to invest in a rather expensive mortising attachment for your drill press.

On the other hand, a slot mortise is rounded at each end. To make it, you drill a series of holes and then clean up the cheeks (sides) with a chisel.

At least that's the way I used to do it. But I got tired of cleaning up the cheeks, and figured there had to be an easier way. There is. I simply replaced the drill bit with a straight-faced router bit — which does both the "drilling" and cleaning up.

First I cut the stiles to length to fit the opening of the cabinet. (In the case of the hutch, this should be a very tight fit.) Then I marked out the length and depth of the mortise at each end of the stile (Fig. 1).

To make the mortise, I clamped a fence to the drill press table. Then the stile is held against the fence with a spring board. The mortise is roughed out by "drilling" a series of holes with a ¼" router bit (speed 4200 RPM).

The router bit may argue with you about doing this drilling operation (drilling is not really in its contract), but it will get the job done. After drilling, the cheeks of the mortise are cleaned up by simply moving the stile back and forth as in a typical routing operation (Fig. 2). One note: the cutting edge on the router bit is only ⅞" long, but the bit will cut deeper (to the 1¼" depth needed) if it's done in stages.

Next, the rabbet is cut in the stile. Though the finished rabbet should be ½" deep and ¼" wide, the actual dimensions of the rabbet are determined by the position of the mortise (Figs. 3 and 4). And, just so everything lines up, as each cut is made on the door stiles, also make the same cut on all of the door rails (that is, cut the rabbets before the tenons are cut.)

THE TENONS

The method I use for cutting a tenon is certainly not a typical approach. Usually a tenon is cut on a table saw by standing the rail on end in a tenon jig, and passing it through the blade to cut the cheeks.

However, when doing it this way there's a tendency to concentrate on the fit of the tenon in the mortise, while forgetting the shoulder cut. On the other hand, the method shown here places the emphasis on cutting the shoulder, yet still provides a very accurate way to cut the tenon to the proper thickness.

Before any cuts are made, all of the rails are cut to approximate length (15¾") — which allows 12¾" between the stiles, plus 1¼" for each of the tenons, plus ½" for safety.

The basic technique is to use the mortise to set the depth of cut for the cheek of the tenon (Fig. 5). Then the fence is adjusted (Fig. 6) so the left edge of the blade cuts exactly on the shoulder line.

Thus, the first cut establishes the shoulder as well as the thickness of the tenon . . . all at the same time. To complete the cheek, just make a series of passes out to the end of the tenon.

So, what's the big deal about establishing the shoulder cut? Well, the next step is to cut the face-side cheek at the other end of the rail. And here the critical measurement is *not* the length of the tenon (nor the overall length of the rail) but rather the *shoulder-to-shoulder distance* between the tenons (12¾"). This is because the stiles butt up against the shoulders, and it's here that the actual width of the door is determined so it fits in the cabinet.

After the shoulder to shoulder distance is marked off, trim off the end of the rail so the tenon is the right length. Then cut the face-side cheek at this end.

Now the back-side cheek can be cut. And again, the mortise is used to determine the depth of cut (Fig. 8). In order to determine the shoulder line on this cut, hold the pieces as shown in Fig. 9. (This requires three hands.) Then adjust the fence so the first cut is on this shoulder line.

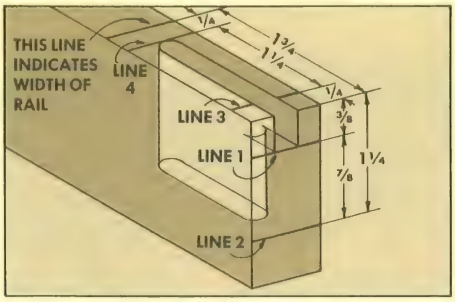
Before making the shoulder cut, however, make a trial cut at the end of the tenon so you can test the fit of the tenon in the mortise and make any necessary adjustments before making the shoulder cut.

The last cut is to form the haunch (Fig. 11). You can measure for this cut, but I usually just sneak up on it until the haunch fits in the notch.

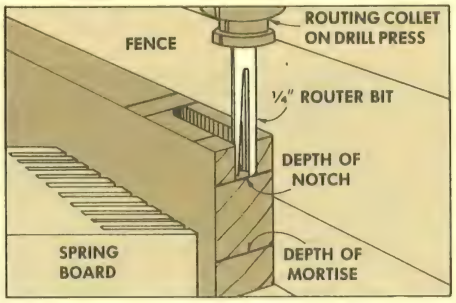
Finally, the tenon is rounded over with a four-in-hand rasp to fit the rounded ends of the mortise (Fig. 12). Now test the fit. The tenon should slide into the mortise with hand pressure — not too tight, not too loose. Kind of a ssshaa-chunck.

And there it is . . . a perfect slot mortise and staggered-shoulder haunched tenon with a concealed rabbet. (It's a good deal easier to make than to pronounce.)

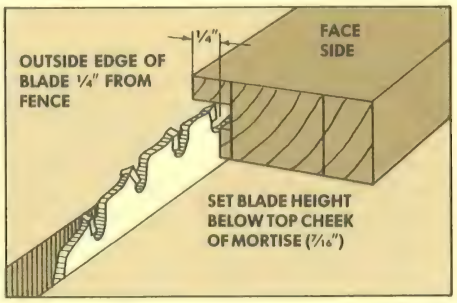
Step by Step



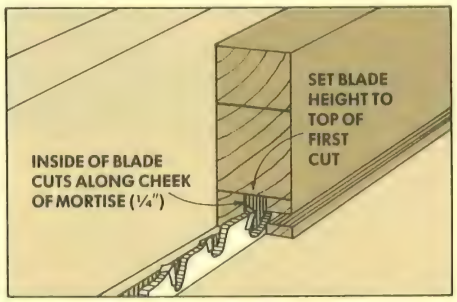
1 *Mark mortise with four lines: 1) for depth of notch for haunch, 2) depth of mortise, 3) length of notch/where mortise begins, 4) total length of mortise.*



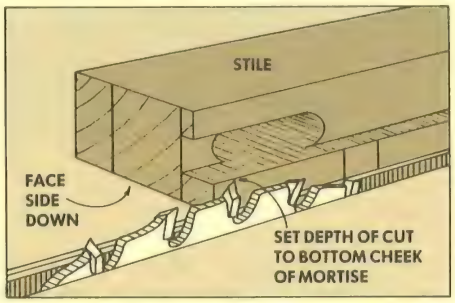
2 *Use ¼" router bit mounted in router collet to "drill" and clean out mortise. First pass is made with bit at depth of notch, second pass at depth of mortise.*



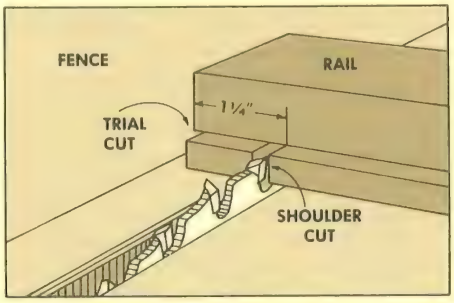
3 *First cut for rabbet: Use mortise to set depth of cut — just below the top (face side) cheek of mortise. Adjust fence as shown. Make cut on stiles, then on rails.*



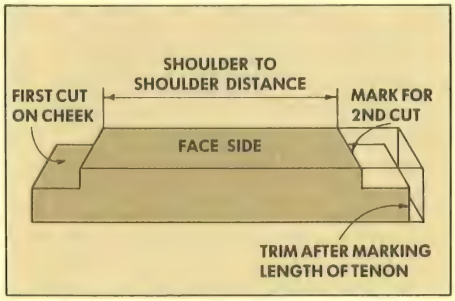
4 *Second cut for rabbet: Set blade height to top of first cut. Then adjust fence so inside of blade cuts along cheek of mortise (¼"). Cut both stiles and rails.*



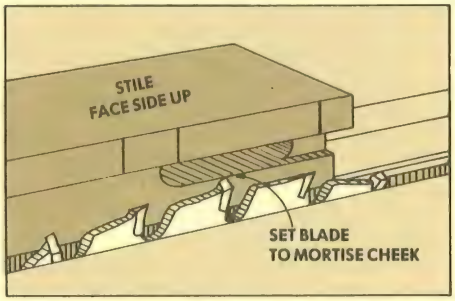
5 *Cheek of tenon can be accurately cut by using mortise to set depth of cut. For first cut place stile face-side down and set depth of cut to bottom of mortise.*



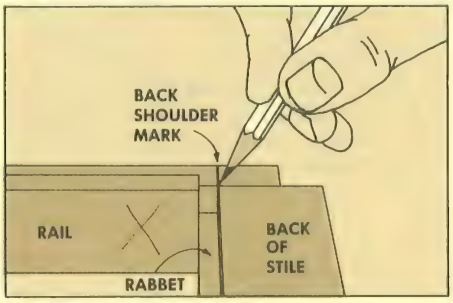
6 *Position fence 1¼" from outside of blade. First, make trial cut at end to check accuracy of depth of cut. Then make shoulder cut and clean out remainder.*



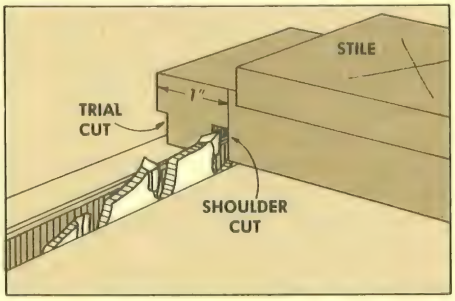
7 *To mark the shoulder cut on the other end of the rail, mark off the shoulder to shoulder distance. Trim off this end of rail so length of tenon fits mortise.*



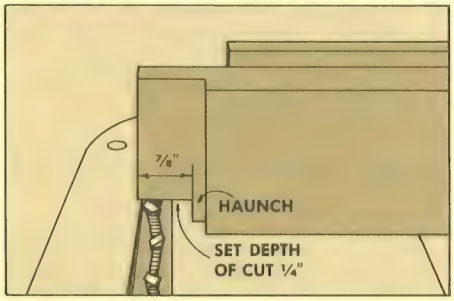
8 *Second cut on tenon sets thickness to match mortise. Once again, use mortise to set depth of cut — this time with back side of stile down (face side up).*



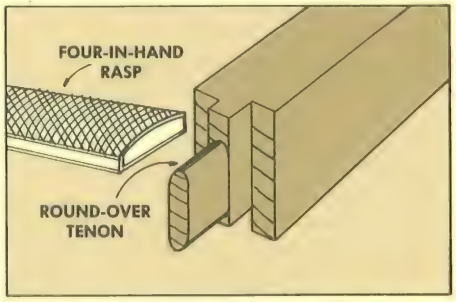
9 *The shoulder on this side of the tenon is "staggered" to match the rabbet in the stile. Hold the stile against the first shoulder cut and mark off rabbet's depth.*



10 *Adjust fence to make shoulder cut on marked line. Before shoulder cut, make a trial cut at the end of the tenon and test fit. Then continue as in Step 6.*



11 *Trim top edge of the tenon so it fits mortise. Stop the cut in order to leave the haunch which fits in the notch in the mortise. (I usually eye-ball this cut.)*



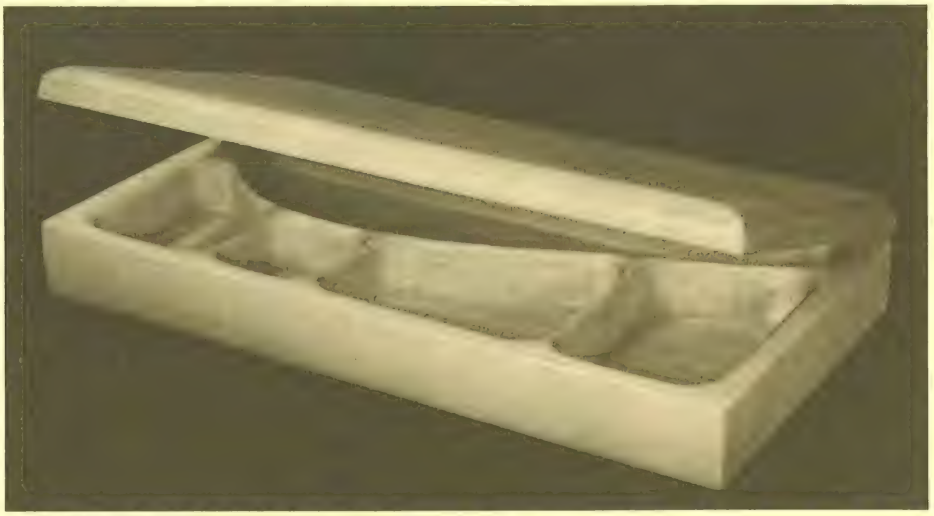
12 *The last step is to round-off the edges of the tenon with a four-in-hand rasp. The tenon should fit the mortise with a smooth, but firm, friction fit.*

Routed Box

A BOX WITH NO JOINTS

I think the nicest thing about this box is realizing that it's made from one solid chunk of wood. It has a continuity (and certainly a delicacy) about it that simply can not be achieved by joinery.

On the other hand, it was a struggle trying to figure out how to route the "walls" dividing each of the small trays. The basic procedure we *wanted* to follow was to cut out a template and use a router with a guide bushing to route the pattern. That's simple enough. But it took several frustrating experiments before we finally figured out how to do it with *existing* router bits and attachments. But, the first step is to make the template.



THE TEMPLATE

To a large extent the construction of the template depends on the equipment you're using. For this project we used *Sears* equipment: 1 HP router and a No. 9-25079 5/16" (inner diameter) guide bushing. (On other brands it may be called a template guide.) This bushing has an outside diameter of approximately 7/16" and extends about 1/8" below the base of the router.

If this bushing is used with a 1/4" router bit, it means that there will be a 3/32" lip between the edge of the template and where the bit actually cuts the wood. Since all of the interior "walls" of this design would have this 3/32" lip on each side (totaling 3/16"), the corresponding template wall could only be 1/16" wide (Not very sturdy.)

The solution is to do the routing in three stages, using the guide bushing and a 1/4", then a 3/8", and finally a 1/2" straight bit. Now, back to the template.

On the next page we've drawn a scale version of the design we used on this box. If you want to use this pattern, it can be scaled up on graph paper.

When making the template, there are a few critical points to keep in mind. 1) No matter what design you choose, the thickness of all the interior walls on the template should be at least 1/4" wide. And the four outside edges of the template should be at least 1/2" wide (particularly at the ends where the end grain will be a weak spot.)

2) We tried several kinds of plywood (Fir and hardwood veneer) for the template — none of which worked very well. The problem is 1/4" plywood just doesn't have the strength along the 1/4"-wide interior walls. We finally struck on the idea of laminating a layer of white *Formica* on the plywood — it's thin, it added the strength we needed, and it's relatively easy to work with.

3) Before cutting the template, I cut the wood for the base of the box to size. For this box I chose 5/4 Maple (1 1/16" actual) cut to 5 1/4" x 10 1/2". Next I cut the template to size — leaving a 1" border to the outside of the wood (7 1/4" x 12 1/2"). Then I placed the block of wood on the *Formica* side of the template and traced its perimeter. Then the pattern for the interior walls could be positioned and traced. (If you use *Formica* with a hard, glossy finish, rough up the surface with some 400 grit Silicon Carbide paper so it will accept the tracing.)

4) In order to position the template on the block of wood, the outline of the outside edges of the wood must be drawn on the underside of the template. I simply measured in from each edge on the top and marked this measurement on the bottom.

5) Now the template can be cut out. The easiest way to achieve the rounded corners at each corner of the "trays" is to drill 3/4" holes. (I used a *Stanley* Power Bore bit.) Then the trays can be cut out with a sabre saw (Fig. 1). All edges of the template must be filed and sanded to perfection. Any bumps will be transferred to the wood . . . and a real hassle to sand out.

6) Finally, the wood block is positioned on the bottom of the template and 3/4" x 3/4" cleats are tacked around the edges (Fig. 2) to hold the template in place while routing.

ROUTING THE PATTERN

The whole trick to routing this pattern is to do it in stages. For the first stage I attached the 5/16" guide bushing to the base of the router and mounted a 1/4" bit so it could extend a maximum of 1 1/8" from the base of the router. (Because the template is 1/4" thick this means an actual cutting depth of 7/8".)

As shown in Fig. 3, position the bit over one of the trays and tilt it into the wood until the base comes to rest on the template. First I routed around the perimeter of each tray (moving in a clockwise rotation). Then it's just a matter of cleaning out the remaining center portion.

When all the trays are routed with the 1/4" bit to a total depth of 7/8", I switched over to a 3/8" bit. Of course, the 3/8" bit will not fit inside a 5/16" bushing. Instead, the entire cutting edge of the bit extends to the outside edge of the bushing. This allows the bit to cut off the lip left by the 1/4" bit.

Then a 1/2" bit is mounted in the router, which means the cutting edge extends 1/16" to the outside of the bushing and actually cuts underneath the template — thus leaving 1/8"-thick walls between the trays.

The final step is routing with a 1/4" radius quarter round bit. This can be done without the use of the template or the guide bushing — just free-hand it.

THE FINISHING STEPS

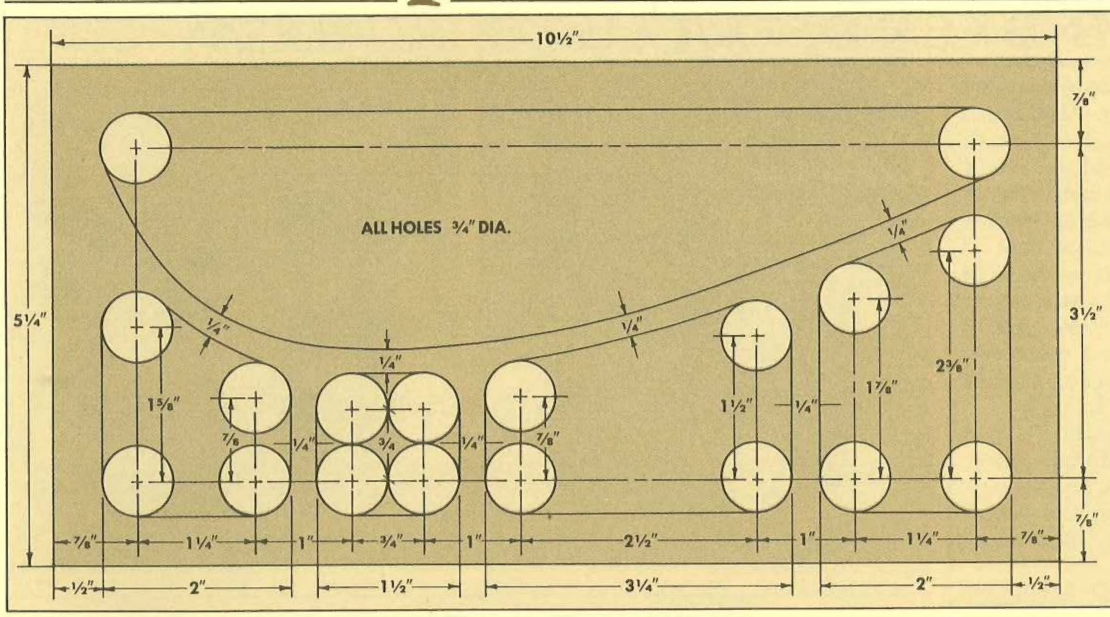
After all the routing is done, there will probably be some burn marks and rough spots on the walls. I sanded these by using a make-shift sanding drum (Fig. 6).

The top is then cut to size (I used 1/2" Maple for the top) and the edges on the front and the two ends are rounded over. (The back edge is left straight in order to mount the hinges.)

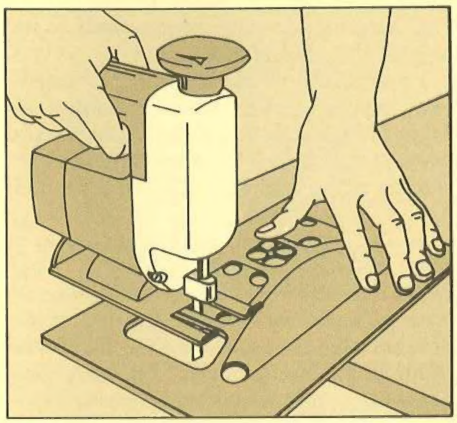
I used *Stanley* No. CD5310 5/8" x 1" Brass Ornamental Hinges. (These hinges come with escutheon pins, which I replaced with No. 6 x 1/2" brass round-head screws.)

And finally, I finished the box with three coats of *Watco* Danish Oil.

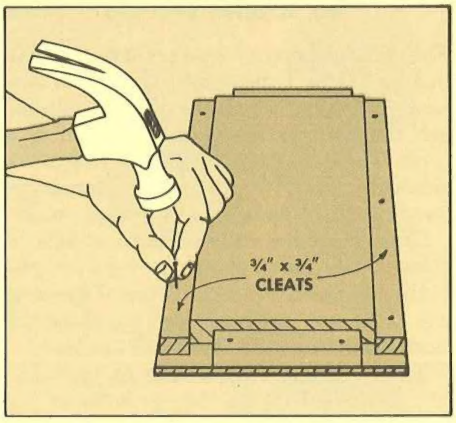
Template & Routing



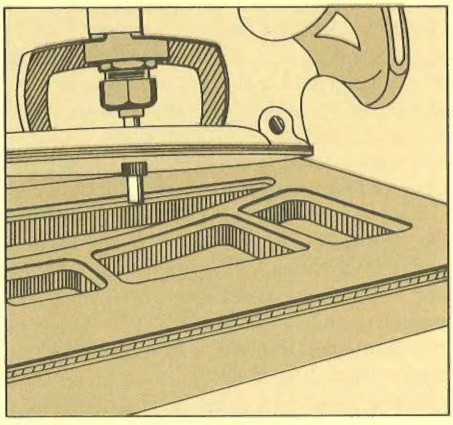
This pattern is drawn to a ½"; 1 scale. It can be scaled up on graph paper. However, since this may be a hassle, if you want a full-size pattern, we will send one for $1. Just write to us and ask for Pattern RB.



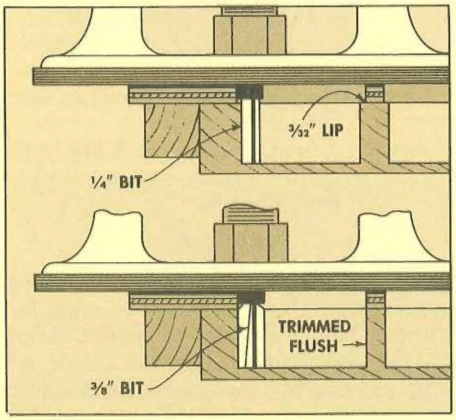
1 *After tracing the pattern on the template, drill ¼" holes at each corner. Then cut out the pattern with a sabre saw. File and sand the template to perfection.*



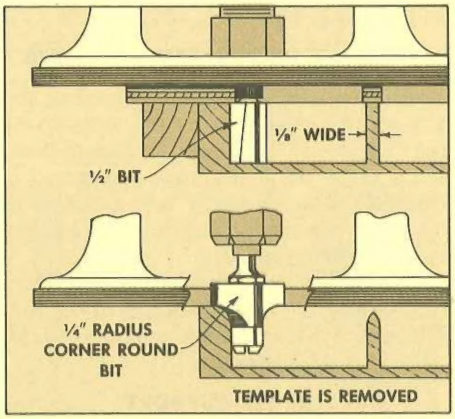
2 *Transfer the outline of the wood block to bottom of template. Then place the block on this outline and nail cleats around the block to hold it in place.*



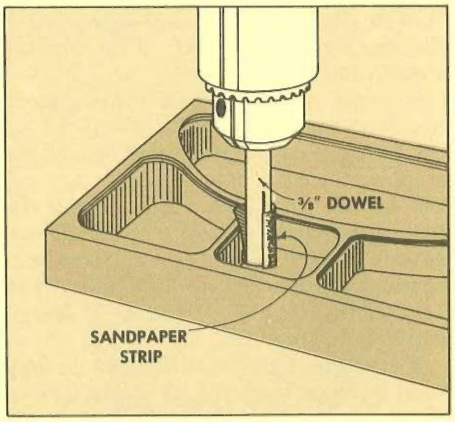
3 *Mount router bit for a maximum travel of 1⅛" below base. Then adjust to make ⅛"-deep cuts with each pass. Route each tray in a clockwise rotation.*



4 *Top: the first pass on each tray is with a ¼" straight bit. This leaves a 3/32" lip beyond the edge of the template. Below: second pass, with ⅜" bit, trims off lip.*



5 *Top: ½" bit extends 1/16" beyond bushing and cuts underneath the template, leaving interior walls ⅛" wide. Below: all edges are rounded over.*



6 *Burn marks and rough spots can be sanded with improvised sanding drum — ⅜" dowel with strip of sandpaper. (This can be done with electric drill.)*

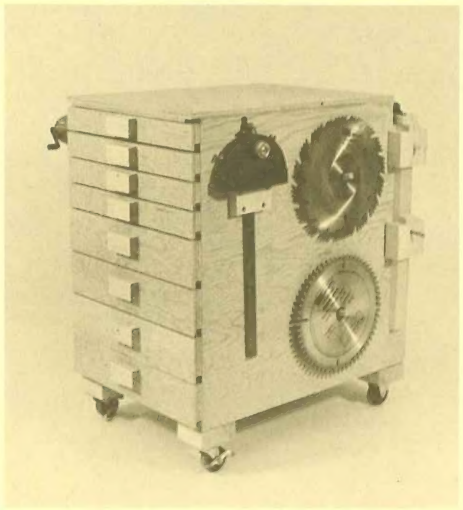
Shop Cart

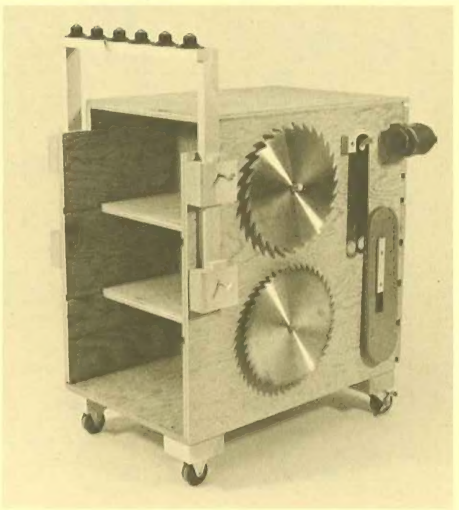
CONVENIENCE AND STORAGE UNDER THE TABLE SAW

I've been wanting to build a little shop cart like this for about two years. Well, that's not really true. What I really wanted was a roll-around table to store workpieces as I was cutting them. And, I needed a rip support to support long (or wide) boards when I didn't have a helper around.

And of course I needed somewhere to store extra saw blades, the miter gauge, and other accessories for the saw. And it might be nice to have a small cabinet to store the molding head, the dado set, and a few other little odds and ends.

But then, if I built all this stuff, I'd need a new shop to hold it all. And that's where this cart comes in. I call it my everything-has-a-place, wheel-around-the-shop, store-under-the-table-saw shop cart. (Sam, for short.)





THE BASIC BOX

As shown in the Cutting Diagram, I managed to get all of this out of two half-sheets of plywood and a few 1x4s. I began construction by cutting the sides and top from a 4' x 4' sheet of ¾" A-C plywood. (Most of the waste from this sheet is used for the drawer fronts and the two shelves in back.)

The bottom and the divider are cut from the half-sheet of ½" plywood as shown, and the rest of this sheet is used for the "sliding shelves." (You could get by with ⅜", or maybe even ¼", plywood for these pieces, I just happened to have ½" laying around, so that's what I used.)

Next I cut the sides to size, cutting a notch in the top back corner of each piece. Then each of these side pieces gets a whole series of dadoes cut in it for the sliding shelves.

Instead of cutting these dadoes exactly ½" wide, I added a cardboard shim to make the cut just a tad wider so the shelves would slide easily.

In order to insure that these dadoes match on each side, I set the fence to cut the top dado on the right side piece first, stopping the cut a little over half way from the center. Then, without changing the fence, I placed the left side piece on the saw so the cut *started* a little over half way from center and stopped at the front edge. Then I moved the fence over to make the second cut from the top, etc., etc.

Two of these cuts go all the way through (that is, from front edge to back edge) for the shelves in the back. And a cross-grain groove is cut for the divider/stiffener.

Then it's just a matter of cutting the rabbets in the top and sides, and gluing and nailing the basic box together.

THE SLIDING SHELVES

The sliding shelves (drawers) are a simple matter. First I measured the actual distance between the dadoes in the sides to get the measurement for the shelf bottoms. These bottoms should be cut just a smidgen less (1/16") than the distance between the two dadoes so they slide easily.

Then I cut the drawer front to size so there would be ⅛" clearance between the bottom of one front and the top of the next one. A ½" x ½" rabbet is then cut along the front edge to accept the shelf's bottom.

To give the shelves a little extra stability, I decided to cut two grooves in the bottom for the sides (Fig. 3). The distance between the outside edges of these grooves should be about 1/16" less than the actual distance between the cart's sides. Finally, the shelf's sides and back are glued and nailed in place.

HANGERS, HOOKS, AND SUPPORTS

Now comes the fun part. I wanted to add all sorts of hooks, hangers and supports for the various saw accessories. Most of these are a variation of the hook diagramed in Detail C. But it's really just a matter of figuring out a convenient shape for a gizmo to hang other gizmos.

One thing I did try to do was keep all of these things below the surface of the top. This way workpieces can be placed on the top with no interference.

THE RIP SUPPORT

Which leads us to the rip support on the back end of the cart. In the first photo at the top of this page, the rip support is shown in the "down" position — out of the way. In the second photo it's shown in the "up" position — which corresponds to the height of my table saw.

I wanted this support to be adjustable — even in very small increments. Sometimes I need to lower it just a little because of a warped board. Or, there may be a bump or shallow in the floor that must be accounted for.

So . . . I made a U-shaped collar out of some scrap 2x4. Inside this collar is a T-nut (which is a nut with a flange and prongs so it can be nailed into wood). A thumb screw goes through the collar, into the T-nut, and tightens against a "shoe." The shoe prevents the thumb screw from wearing a hole in one spot on the leg of the rip support, and also distributes the pressure over a wider area.

The rip support is made to fit against the sides of the cart. On the top of the arm are six socket casters (which I purchased locally). If this type of caster is not available, you could simply screw a large dowel (closet rod) to the legs so a board can slide over it.

Finally, I fastened some 2x4 blocks to the bottom of the cart and mounted platform-type locking casters.

OPTIONS

After I finished this cart, a friend stopped by and said, "Hey, this would be great for storing all my (photographic) slides." Then Ted said he wanted one for storing his art supplies, paper, pens, instruments (and crayons).

Then I decided I needed one for storing nails, screws, and an assortment of tools. Then another friend stopped by and wanted one for . . . .

MATERIALS LIST

A	Side	¾ x 23¾ - 23¾
B	Top	¾ x 16 - 21¾
C	Drawer Fronts (4)	¾ x 2 - 16
D	Drawer Fronts (4)	¾ x 3½ - 16
E	Back Shelf (2)	¾ x 8 - 15
F	Bottom	½ x 15½ - 23¾
G	Divider	½ x 14 15/16 - 23
H	Shelf Bottom (7)	½ x 11½ - 14 15/16
I	Shelf Bottom (1)	½ x 11 - 14 15/16
J	Shelf Sides (8)	¾ x 1⅜ - 11
K	Shelf Sides (8)	¾ x 2⅞ - 11
L	Shelf Backs (4)	¾ x 1¼ - 13⅞
M	Shelf Back	¾ x 2¾ x 13⅞
N	Rip Support Leg (2)	¾ x 1⅜ - 18
O	Rip Support Top	¾ x 2 - 17½

FIGURE 1

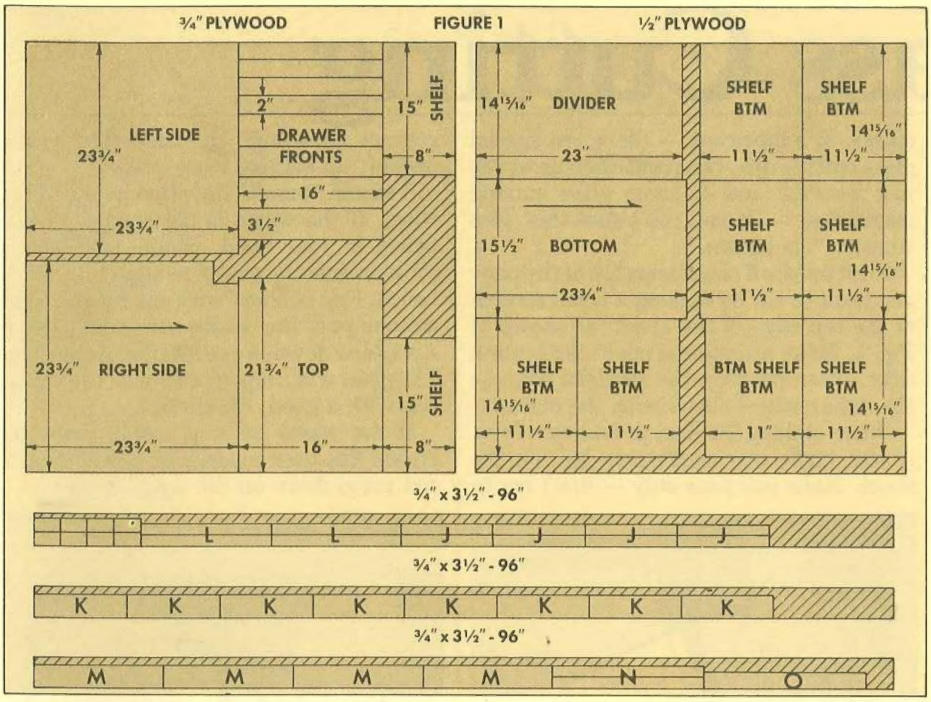


FIGURE 5

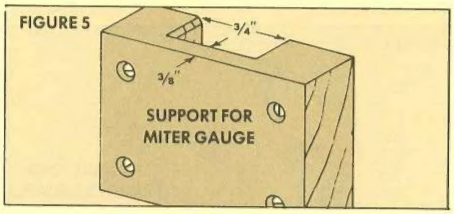


FIGURE 2

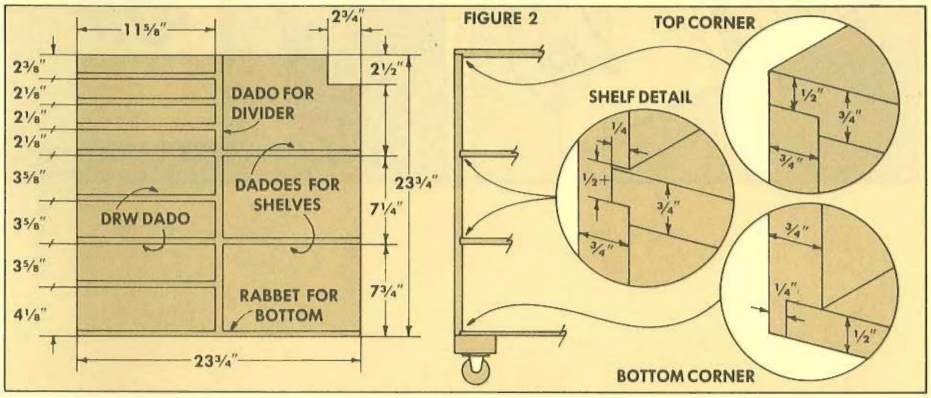


FIGURE 4

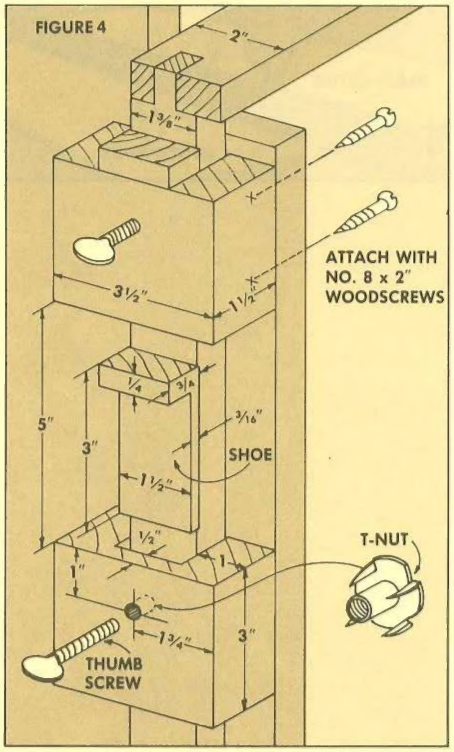
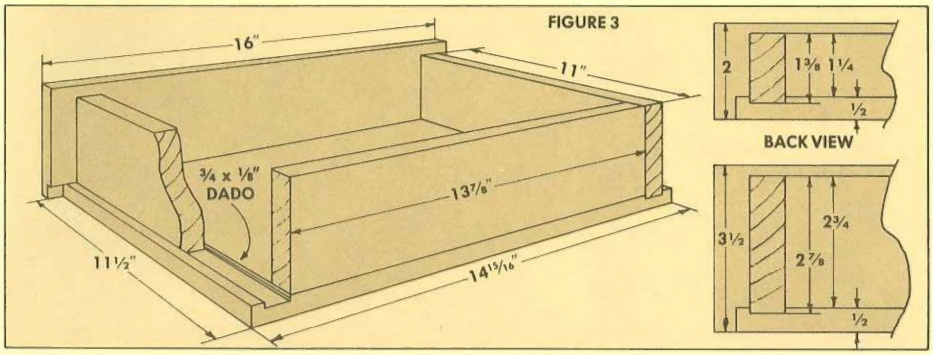
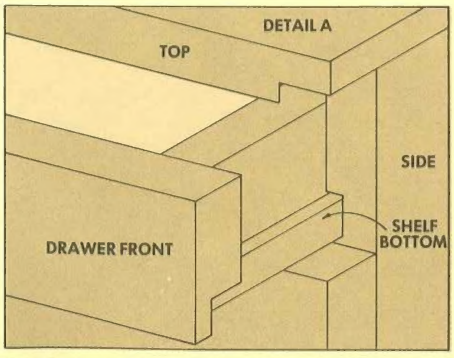
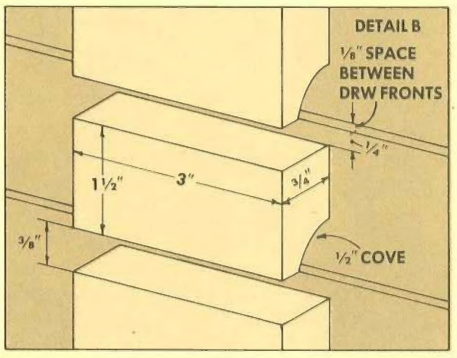
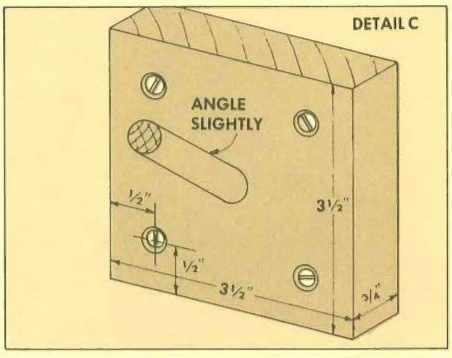


FIGURE 3









Glass Cutting

Cutting glass seems to be one of those mysteries that defies logic. All you have to do is make a tiny little scratch on the surface of the glass, apply a little pressure and snap! the glass breaks exactly along the scratch.

For most furniture applications, single strength, ⅛"-thick glass is sufficient. Before cutting the glass, measure the frame opening and deduct ⅛" from both the height and width to allow for expansion.

Now you need a few simple tools: 1) a glass cutter, available at almost any hardware store; 2) a straight edge (a framing square works well) to guide the glass cutter; 3) a lubricant — there are special glass cutting oils, but paint thinner works just as well; and 4) some glass cutting magic dust — if you can't find this, just whisper "ala-kazam."

First mark off one dimension of the pane you want to cut by making a small scratch at the top edge of the sheet, as shown in Fig. 1. Make a similar mark at the bottom edge. Then position the straight edge so the cutter wheel aligns with the marks.

When etching the line, press down firmly and make one continuous line on the sheet. Make *one* pass only — don't try to correct anything, or make the scratch deeper, by making more passes.

You can "break" the glass in one of two ways. If the waste is big enough to hold firmly in your hand, simply position the scratch directly over the edge of a workbench, Fig. 2. Now, with one firm, smooth motion *pull* the waste away and down. Away and down in one motion. Ala-kazam. The glass will snap precisely on the etched line with a good, clean edge.

If the waste piece is small, place the etched line over a pencil or dowel (Fig. 3) and press down on the waste piece.